International Journal of Engineering Applied Sciences and Technology, 2017
Vol. 2, Issue 5, ISSN No. 2455-2143, Pages 126-133
Published Online March-April 2017 in IJEAST (http://www.ijeast.com)

PROBABILITY BASED TECHNIQUE TO IMPROVE PERFORMANCE OF WJSR TECHNIQUE FOR IMAGE DE-NOISING

Mandeep Kaur
Dept. of CSE
CTITR, Jalandhar, India

Deepinder Kaur
Assist. Professor
Dept. of CSE
CTITR, Jalandhar, India

***Abstract*--- The image processing is the technology in which the pixels of the image processed. The image restoration technique is applied which will restore the quality of the image. The image de-noising technique is applied for the image restoration. The weight based joint sparse representation is the technique which is applied to de-noise the image based on their internal and external features. In this paper, improvement in the WJSR technique is proposed in which the probability is calculated that weather the pixel is noisy or not. The performance of the proposed algorithm is tested in terms of PSNR, MSE, SNR and execution time.**

Keywords—***Image, Denoising*, Probability, Weighted joint sparse representation (WJSR), PSNR.**

I. INTRODUCTION

Pictures compactly pass on information about positions, sizes and inter-relationships between objects. They portray spatial information that we can recognize as objects. Human creatures are great at deriving information from such images, in view of our innate visual and mental abilities. Around 75% of the information received by human is in pictorial form. A digital remotely sensed image is commonly composed of picture elements (pixels) located at the intersection of every row i and column j in every K groups of imagery. Associated with every pixel is a number known as Digital Number (DN) or Brightness Value (BV) that depicts the average radiance of a relatively small area inside a scene. A smaller number indicates low average radiance from the area and the high number is an indicator of high radiant properties of the area. The size of this area impacts the reproduction of details inside the scene. As pixel size is reduced more scene detail is presented in digital representation [1]. Geometric distortions manifest themselves as errors in the position of a pixel relative to different pixels in the scene and with respect to their absolute position inside some defined map projection. In the event that left uncorrected, these geometric distortions render any data extracted from the image useless. This is especially so if the information is to be compared to other data sets, whether it is from another image or a GIS data set. Distortions happen for some reasons. Rectification is a process of geometrically correcting an image so it can be represented on a planar surface, conform to different images or conform to a map. Image Processing is a method to enhance raw images received from cameras/sensors set on satellites, space probes and air ships or pictures taken in normal day-today life for different applications. Different methods have been developed in Image Processing amid the last four to five decades. The majority of the strategies are developed for enhancing images got from unmanned spacecrafts, space probes and military reconnaissance flights. Image Processing systems are getting to be distinctly popular because of simple availability of powerful staff PCs, extensive size memory devices, graphics software and so forth [2].

A. **Image Enhancement---**

Sometimes images which are gained from satellites and cameras has low quality of brightness and contrast since restrictions of imaging sub system and light while catching image. Image has diverse sorts of noise. In image enhancement, the goal is to accentuate certain image highlights for resulting analysis or for image show. Contrast and edge enhancement are its cases. The enhancement methodology does not extend the intrinsic data content in the data itself. It explains certain foreordained image qualities. Enhancement computations are generally interactive and application subordinate

B. **Image Restoration---**

It is concerned with filtering the watched image to minimize the effect of corruptions. Sufficiency of image restoration depends on upon the degree and precision of the knowledge of degradation technique and what's more on channel plot. Image restoration shifts from image enhancement in that the latter is concerned with more extraction or accentuation of image elements.

C. **Image De-noising---**

Unwanted information in an image is known as noise. Noise produces undesirable effects such as artifacts, unrealistic edges, unseen lines, corners, blurred objects and disturbs background scenes. Prior learning of image is required to reduce effects of the noise. Here we will discuss few noise models, their types and categories in digital images:

a. Gaussian Noise or Amplifier Noise/ Additive Noise: Probability density function [PDF] of the normal distribution is present in a noise. It is also known as Gaussian distribution. This part of image is present in dark area of noise with constant level of noise signal.The Let f'(x,y)be the noisy digitized version of the ideal image f(x,y)and n(x,y,)/be a .noise function, which returns random values coming from an arbitrary distribution. Then *additive noise* can be described by Additive noise is independent of the pixel values in the original image. Typically n(x,y)is symmetric about zero. This has the effect of not altering the average brightness of the image, or large parts thereof. Additive noise is a good model for the thermal noise within photo-electronic sensors

b. **Uniform Noise:** The uniform noise cause by quantizing the pixels of image to a number of distinct levels is known as quantization noise. Uniform distribution is used in this noise. The level of the gray scale values of the noise in the uniform noise are uniformly distributed across a specified range. Uniform noise can be used to generate any different type of noise distribution [3]. Mostly noise is responsible for the degradation of the image level.

c. Salt and Pepper Noise: The salt-and-pepper noise are also called impulse noise, spike noise, shot noise caused by the malfunctioning pixel elements, faulty memory location in the camera sensors and timing error in the digitization process. There are only two possible values exists that is a and b in salt and pepper and the probability of each is less than 0.2.If the numbers greater than this numbers the noise will swamp out image. For 8-bit image the typical value for 255 for salt-noise and pepper noise is 0.

D. **Filtering Technique for Image De-noising FILTERS---**

To achieve number of tasks such as reduction of noise and re-sampling basic function of image processing is applied known as filtering. In the entire image processing, filtering is used as a basic process. The behavior of data and task performed by the each filter is determined by the filtering. By preserving important and useful information, filtering is used to remove noise of the image

Linear Filters: To remove particular type of noise, linear function is used. Averaging filters or Gaussian are suitable for this purpose. These filters are used to blur the sharp edges, destroy the lines and other fine details of image, and perform badly in the presence of signal dependent noise.

Non-Linear Filters: Weighted median, rank conditioned, relaxed median, rank selection are types of non-linear median filter which are developed to overcome the shortcoming of linear filter.

Different Type of Linear and Non-Linear Filters:

Mean Filter: The mean filter is a type of simple spatial filter. It is a sliding-window filter. It replaces the center value in the window. It also replaces with the average mean of all the pixel values in the kernel or window. The window is usually square but it can be of any shape.

Median Filter:

Median Filter which is based on order statistics is a simple and powerful non-linear filter. It is type of soothing image. Median filter is used for reducing the amount of intensity variation between one pixel and the other pixel. In this filter, value is not replacing the pixel value of image with respect to neighbor pixel but it is replaced with the median value. Then the median is calculated by first sorting all the pixel values into ascending order and then replace the pixel being calculated with the middle pixel value [4]. The median filter gives better result when the impulse noise percentage is less than 0.1 %. When the quantity of impulse noise is increased the median filter not gives best result.

Wiener Filter:
The main aim of this filter is to reduce that noise which is caught as corrupted signal. This filter is also based on a statistical approach. For the desired response various filters has been plotted. From a different point of view wiener function is used to reduce noise. The main goal of wiener filter is reduced the mean square error (MSE) as much as possible. This filter is capable of reducing the noise and degrading function.

II. LITERATURE REVIEW

Yicong Zhou et al. (2015) have presented a weighted couple sparse representation model to remove impulse noise (IN). The proposed method achieves better performance in reduction of IN when compared with several state-of-the-art denoising algorithms with respect to both the quantitative measurements and the visual effects [5].**HuanjingYue et al. (2015)** have proposed two stage strategy using different filtering approaches. In first stage graph based optimization is proposed to improve accuracy in external denoising. Preliminary result can be obtained by combining internal and external denoising patches. In the second stage, they propose reducing noise by filtering of external and internal cubes, respectively, on transform domain. The final denoise image is obtained by fusing the external and internal filtering results. Experimental results show that proposed technique gives best results for subjective and objective image [6].**Peixuan et al. (2014)** have proposed a new adaptive weighted mean filter (AWMF) for detecting and removing high level of salt-and-pepper noise. This algorithm was enhancement of adaptive mean filter (AMF). After comparing The AMF And AWMF IT was concluded that detection accuracy of AWMF is more than AMF and it could better perform than many other existing filters [7].**Ming Yan et al. (2013)** proposed two methods based on blind in painting and _0 minimization to remove the impulse noise. These methods can simultaneously find the damaged pixels and restore the image. By iteratively restoring the image and updating the set of damaged pixels, these methods have better performance than other methods[8].**AjitRajwade et al. (2013)** have presented an extremely simple algorithm—the higher order singular value decomposition (HOSVD) of similar image patches in conjunction with hard thresholding and averaging. They have demonstrated its excellent empirical performance in comparison with then state-of-the-art algorithms through a large number of experiments on two full databases[9].**Tao Chen et al. (2012)** proposed a novel adaptive operator, in this the forms estimates based on the differences between the current pixel and the outputs of center-weighted median (CWM) filters with varied center weights. In thisthe proposed technique consistently provides satisfactory results in redact both of the random-valued and fixed-valued impulse noises while still possessing a simple computational structure [10].**Ju-Bo Zhu et al. (2011)** have proposed a new de-noising algorithm based on sparse image representation for removing salt-and-pepper noise. It can detect the salt-and-pepper noise efficiently while preserving the structural information very well. The simulation resultsdemonstrate that this approach provides good de-noising results and outperforms other filters in terms of noise suppression and detail preservation[11].**Wen Gao et al. (2010)** established a novel and general framework for high-quality image restoration using group-based sparse representation (GSR) modelling, which sparsely represents natural images in the domain of group, and explicitly and effectively characterizes the intrinsic local sparsity and nonlocal self-similarity of natural images simultaneously in a unified manner. Experimental results on three applications: image in painting, deblurring and CS recovery have shown that the proposed GSR achieves significant performance improvements over many current state-of-the-art schemes and exhibits good stability [12].

International Journal of Engineering Applied Sciences and Technology, 2017
Vol. 2, Issue 5, ISSN No. 2455-2143, Pages 126-133
Published Online March-April 2017 in IJEAST (http://www.ijeast.com)

III. RESEARCH METHODOLOGY

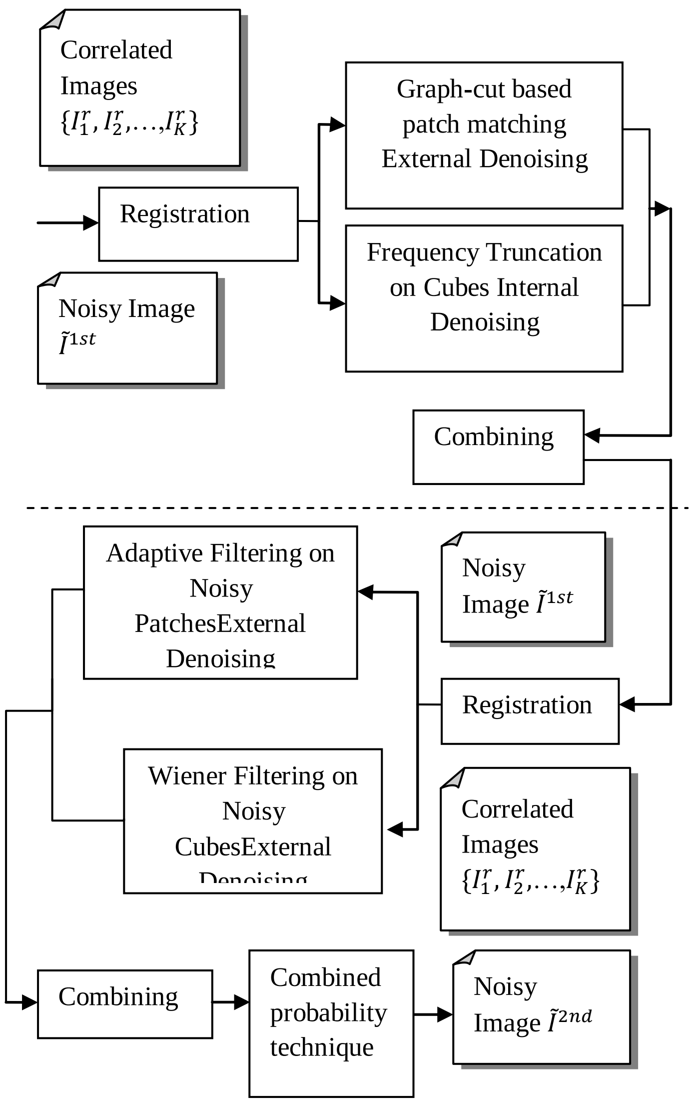


Fig. 1.The framework of the proposed de-noising scheme

The weight based joint sparse representation technique is the efficient technique to remove noise from the image. In the weight based sparse representation technique two steps are mainly followed, in the first step technique of image registration is applied which will register the pixels of the image for processing. In the second phase the internal and external features of the image are processed for the image de-noising. In the proposed technique new step is added for the image de-nosing which is the probability step to find noisy pixels from the input image.

There are two step in our denoising scheme, separated by the blue line in the center. The noisy image is I and its correlated images are $\{I_1^r, I_2^r, \ldots, I_K^r\}$. The denoising results obtained in the first and second stage are denoted as $\tilde{I}^{1st}$and $\tilde{I}^{2nd}$respectively.

A. Internal and External Combined De-noising

There are various complementary strengths for both single image based (internal) as well as learning based (external) de-noising methods. So, the de-noising performance can be enhanced by combining both of these techniques. In a study, the researchers classified the patches into internal and external denoising on the basis of the signal-noise-ratio (SNR) of the patch. Further, in a study, a learning based approach was proposed with the help of neural network in which the denoising results achieved from the internal as well as external denoising methods were combined automatically. Within the previously done research, the merits of both internal and external denoising results have been combined to create a simple and effective frequency domain fusion method. Through this process, the best denoising result has been achieved when compared to the other stand-alone methods available.

B. Correlated Image Registration

On the basis of various aspects, focal lengths as well as illuminations, even the similar correlated images are differentiated. It will be very complicated to search the matched patches directly from the respective images. Also the matching accuracy is minimized in this manner due to the differences in rotation and scale of the candidate patch within the images. The patches present across the scales and rotations can be found with the help of patch matching algorithm. However, due to the optimization process and the absence of true signal information with the noise query, there will be many incorrect results achieved. For solving such issues, an approximate alignment is proposed with the help of geometric registration in this work. The correlation amongst the noisy query and retrieved images is enhanced with the help of this method.

C. Probability Calculation

The technique of probability is applied on the image from which the internal and external features are analyzed for the image de-noising. In the technique of probability each pixel is treated individually.

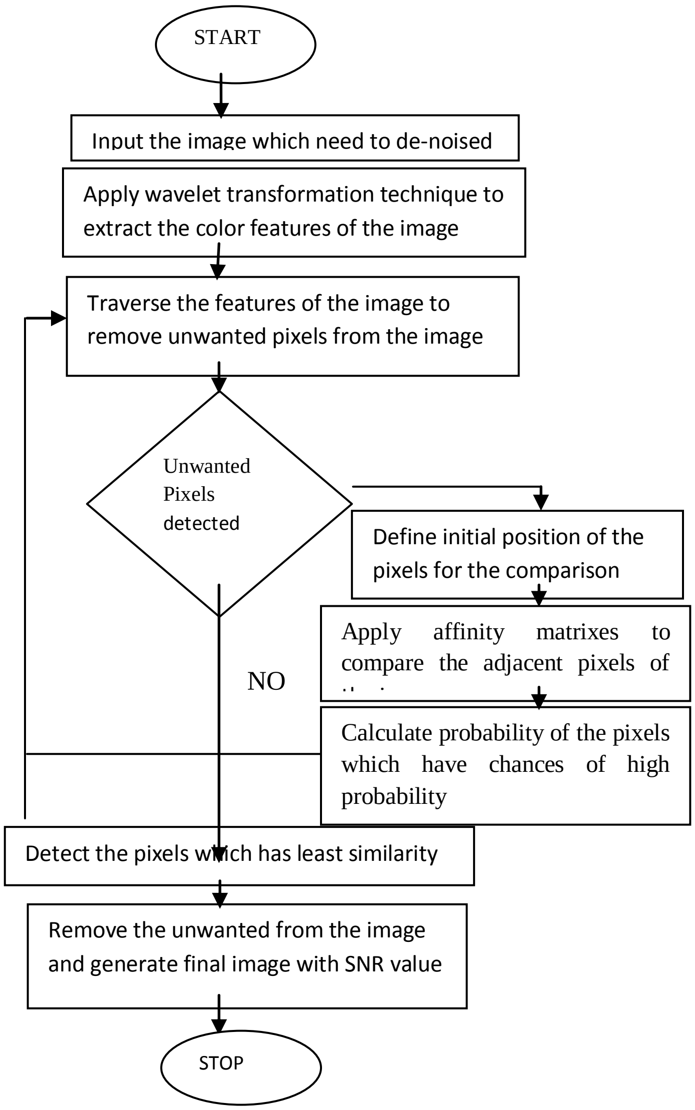


Fig. 2.Proposed Flowchart of probability technique

The similarity between the each pixel in the image is calculated using affinity matrix. The similarity between the pixels will be calculated and each similarity will be traversed.

The point at which discontinued is break will be considered at the pixels of another class. This process will be repeated until all the noisy pixels detected from the image. The detected noisy pixels will be removed from the image and output is considered as final de-noise image based technique.

IV. RESULTS AND DISCUSSION

The proposed technique is been implemented in MATLAB by considering the dataset of grayscale images.

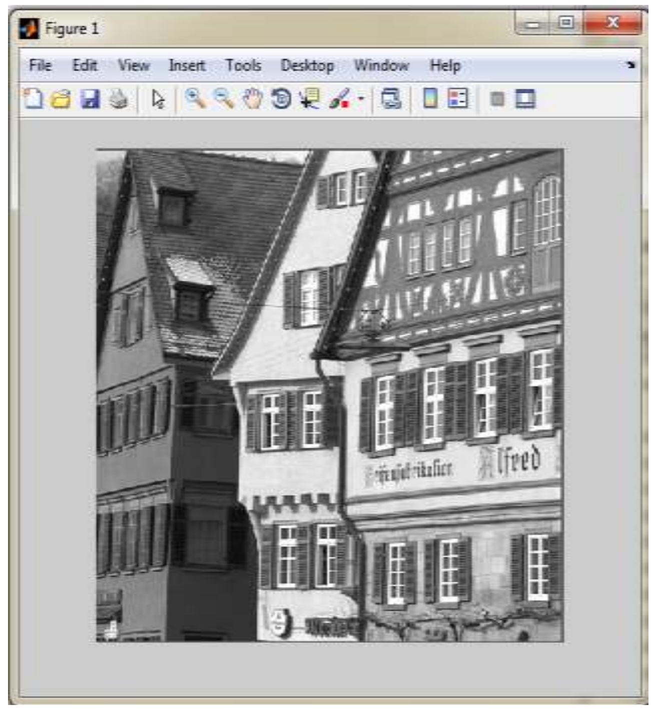


Fig.3. Original image

As shown in the figure 1, the image is taken as input on which the proposed technique needs to be applied to de-noise the image

Vol. 2, Issue 5, ISSN No. 2455-2143, Pages 126-133
Published Online March-April 2017 in IJEAST (http://www.ijeast.com)

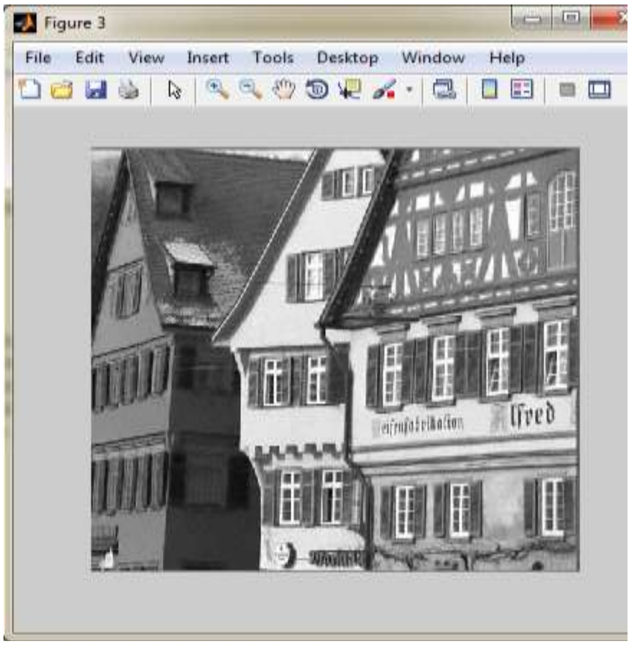


Fig.4.Output of proposed Technique

As shown in the figure 2, the proposed technique is applied which de-noise the image and output is shown of the de-noised image

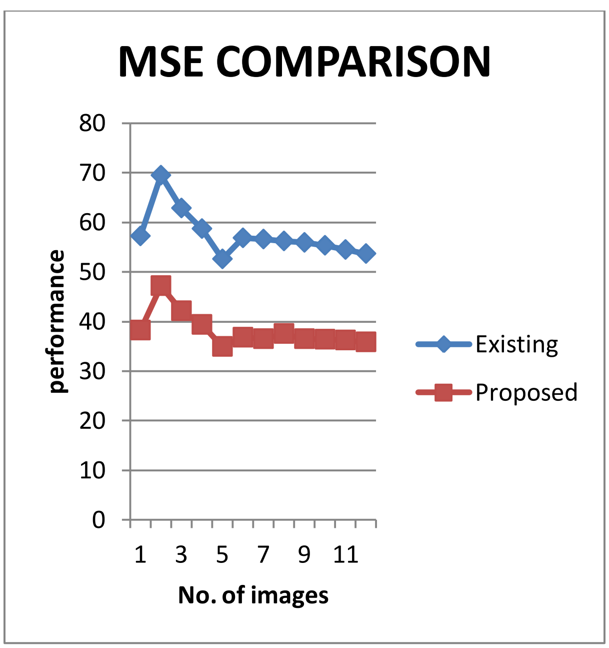


Fig.5.MSE comparison

As shown in the figure 3, the MSE values of the proposed technique and existing technique is been compared, it is been analyzed that MSE of the proposed technique is less as compared to existing technique

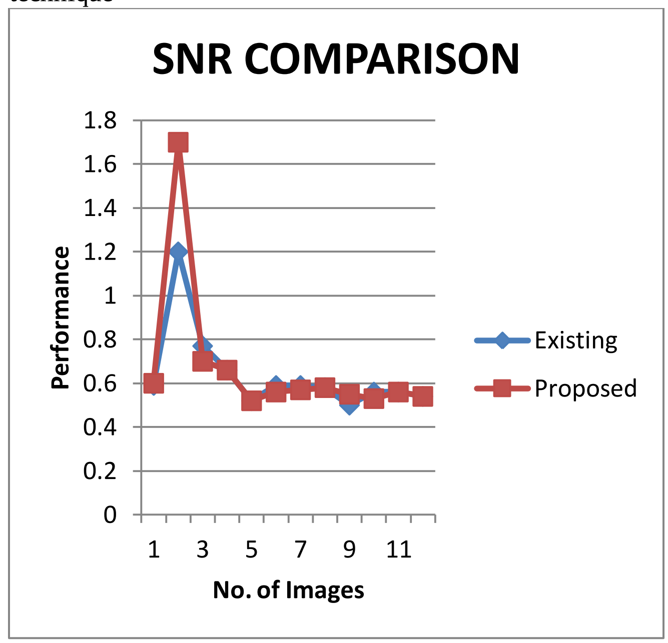
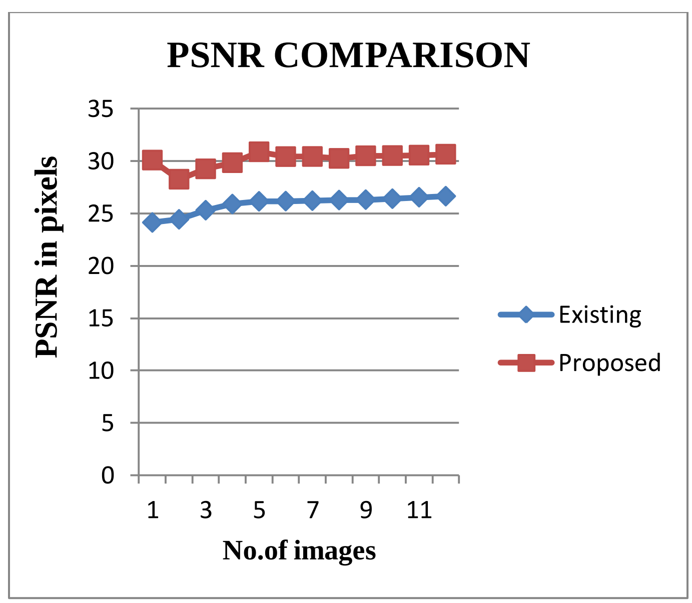


Fig.6.SNR comparison

As shown in the figure 4, the SNR values of the proposed technique and existing technique is been compared, it is been analyzed that SNR of the proposed technique is less as compared to existing technique



International Journal of Engineering Applied Sciences and Technology, 2017
Vol. 2, Issue 5, ISSN No. 2455-2143, Pages 126-133
Published Online March-April 2017 in IJEAST (http://www.ijeast.com)

Fig.7.PSNR comparison

As shown in the figure 5, PSNR of the proposed and exiting technique is compared, it is been analyzed that PSNR value of the proposed technique is increased at steady rate

Fig.8.Time comparison

As shown in the figure 6, the time values of the proposed technique and existing technique is been compared, it is been analyzed that time of the proposed technique is less as compared to existing technique

V. CONCLUSION

In this work, it is been concluded that image de-nosing is the efficient technique for the image restoration. In the Image de-nosing various techniques has been proposed which remove unwanted pixels from the image. Among the proposed techniques weight based joint matrix representation technique is the most efficient technique for image de-noising. The probability based technique is applied in the WJSR technique in which the probability of each pixel is calculated that whether it is noisy or not. The pixels which are noisy will be removed from the image. The performance of the proposed technique is analyzed in terms of SNR, MSE, PSNR and execution time.

VI. REFERENCES

[1] S.-J. Koo, C.-G.Kim, J.-K.An, M.-H.Park, and S.-D. Yeo, "A new method for improvement of response time by data compression using color space conversion," SID Symposium Digest of Technical Papers, vol. 36, no. 1, pp. 474-477, May 2005.

[2] J. Someya, N. Okuda, and H. Sugiura, "The suppression of noise on a dithering image in LCD overdrive," IEEE Trans. on Consumer Electronics, vol. 52, no. 4, pp. 1352-1332, Nov. 2006.

[3] T.B. Yng, B. G. Lee, and H. Yoo, "A low complexity and lossless frame memory compression for display devices," IEEE Trans. on Consumer Electronics, vol. 54, no. 3, pp. 1453-1458, Aug. 2008.

[4] J. Someya, N. Okuda, and M. Yamakawa, "Reducing the memory of compression feedforward driving for a new LCD," Journal of the SID, vol. 12, no. 1, pp. 37-44, March 2004.

[5]. CHEN, P.L.CHUN,"WEIGHTED COUPLE SPARSE REPRESENTATION WITH CLASSIFIED REGULARIZATION FOR IMPULSE NOISE REMOVAL." IEEE TRANSACTIONS ON IMAGE PROCESSING VOL.24,ISSUE.11,PP.4014-4026,MAY(2015).

[6]. Y. Huanjing ,S.Xiaoyan, Y.Jingyu , W.Feng, "Image Denoising by Exploring External and Internal Correlations", IEEE Transactions On Image Processing, VOL. 24, NO. 6, JUNE (2015).

[7].P. Zhang, L. Fang , "A new adaptive weighted mean filter for removing salt-and-pepper noise." IEEE Signal Processing Letters VOL.21,ISSUE.10 pp.1280-1283,NOV(2014).

[8]. R. Riji, "Iterative bilateral filter for Rician noise reduction in MR images." Signal, Image and Video Processing VOL.9,ISSUE 7,pp.1543-1548, JUNE (2014).

[9]. J. Zhang, Z. Debin, G. Wen. "Group-based sparse representation for image restoration." IEEE Transactions on image Processing VOL.23,ISSUE.8, pp.3336 3351,JUNE(2014).

[10]. M. Yan,"Restoration of images corrupted by impulse noise and mixed Gaussian impulse noise using blind inpainting." SIAM Journal on Imaging Sciences VOL.6,ISSUE.3pp.1227-1245,JUNE(2013).

[11]. Rajwade, Ajit, R. Anand, B. Arunava , "Image denoising using the higher order singular value decomposition." IEEE Transactions on Pattern Analysis and Machine Intelligence VOL.35,ISSUE.4,pp.849-862, JAN(2013).

[12]. C. Tao, R. Hong, Wu. "Adaptive impulse detectionusing center-weighted median filters." IEEE Signal Processing Letters VOL.8,ISSUE.1,pp.1-3, JAN (2011).

[13]. W., L. Xiong, "Salt-and-pepper noise removal based on image sparse representation." Optical Engineering VOL.50,ISSUE.9, pp.097007-097007, SEP(2011).